

## Assessment and recommendations

*The Assessment and Recommendations present the main findings of the Environmental Performance Review of Brazil and identify 53 recommendations to help Brazil make further progress towards its environmental policy objectives and international commitments. The OECD Working Party on Environmental Performance reviewed and approved the Assessment and Recommendations at its meeting on 17 June 2015.*

## 1. Brazil's environmental performance: An overview

The world's fifth largest country, Brazil is hugely diverse with respect to climate, vegetation, land use, population, social patterns and economic activity. It is endowed with large areas of fertile soil, huge water and forest resources, and mineral, oil and natural gas reserves. Natural assets have always been a mainstay of its economic development and have a strong social component. Brazilians are proud of their country's natural wealth, and their environmental awareness has increased. As in other emerging economies, economic expansion, urbanisation and rising income levels have also meant increased environmental pressures from growing demand for land, water, materials, energy and transport, as well as increased pollution and waste generation. Managing the natural asset base sustainably and equitably and decoupling economic growth from environmental pressures is paramount if Brazil is to achieve resilient and inclusive economic development.

### **Climate change**

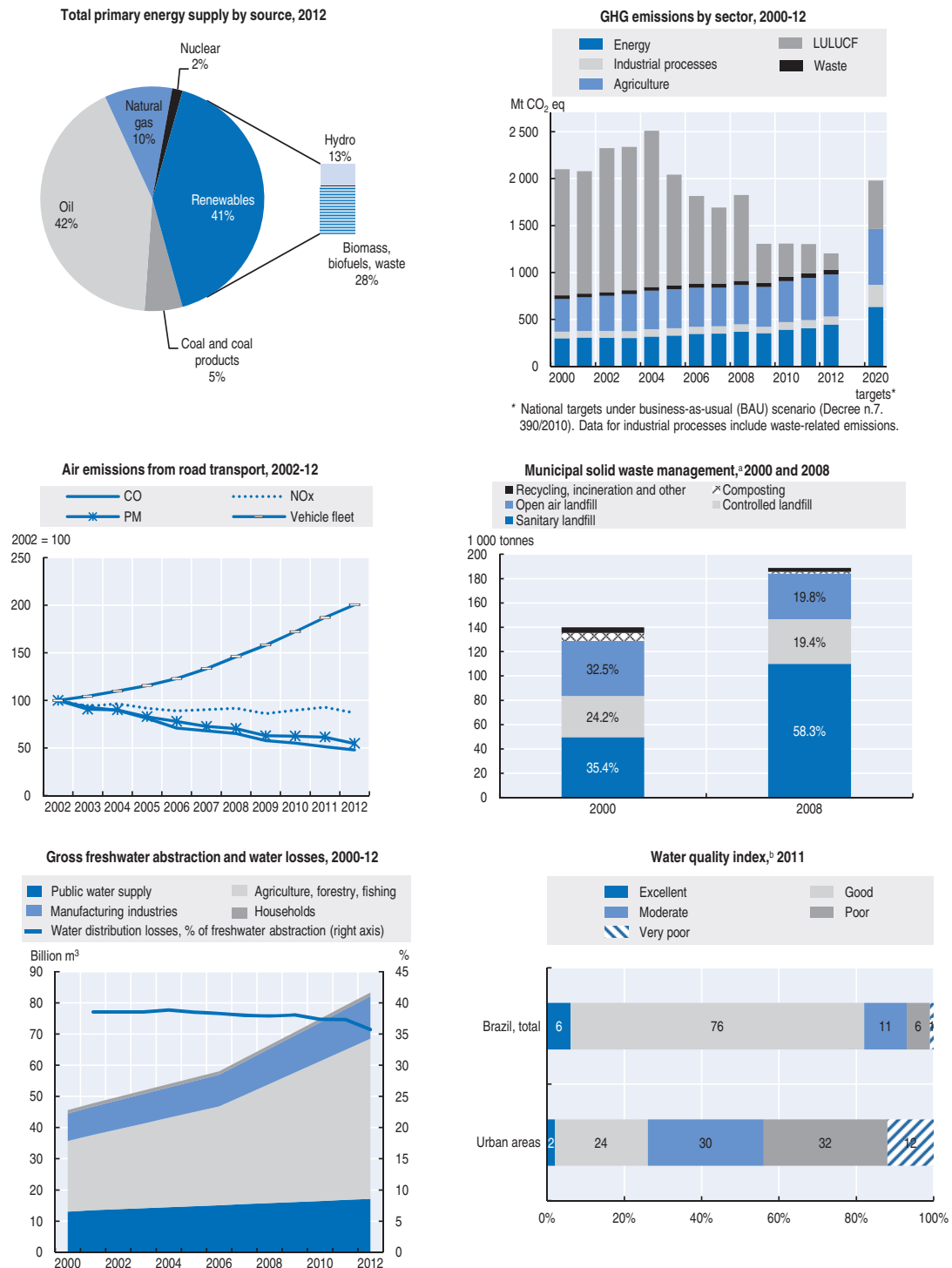
Brazil has a clean, low-carbon energy mix, largely based on the use of renewable energy sources. Renewables, mainly hydropower and biofuels, accounted for more than 40% of total primary energy supply in 2012, one of the highest shares in the world (Figure 1). As a result, greenhouse gas (GHG) emissions from energy generation and use are relatively low compared to many OECD countries. Strong economic growth in the 2000s and the rise of a middle class triggered a rapid increase in energy use, mainly in industry and transport. Nevertheless, the energy intensity of the economy (energy supply per unit of gross domestic product, GDP) remained fairly stable at levels below the OECD average.

The policy framework for climate change mitigation is a positive example of integration of environment-related concerns into sectoral policies. The 2010 National Climate Change Policy established an economy-wide target of limiting projected GHG emissions by between 36.1% and 38.9% by 2020. Brazil launched climate change programmes in sectors such as energy, iron and steel production and agriculture, as well as deforestation control. It is also developing a system, known as SMMARE, to monitor implementation and GHG reduction outcomes of these programmes. Nineteen states have adopted climate change laws and targets, but co-ordination between national and subnational climate policies is fragile.

Brazil has made great progress in reducing its carbon footprint. GHG emissions have declined by more than 40% since 2000; in 2012, they were below the 2020 target (Figure 1). The dramatic decrease in deforestation levels and associated GHG emissions has more than offset the rapid growth in emissions from energy and agriculture, the sectors that today account for the bulk of emissions. Rising demand for mobility has led to a doubling of the vehicle fleet, increased energy use and GHG emissions from transport and higher environmental pressures in many urban areas (Figure 1).

Brazil is developing a climate change adaptation plan. There is consensus that climate change may have considerable negative impact on some economic sectors, notably agriculture and infrastructure, and exacerbate existing pressures, such as water shortages.

Figure 1. Selected environmental performance indicators



a) Includes waste originated from households, offices, institutions, commerce and waste from selected municipal services. Controlled landfill: site operating in compliance with technical control procedures, but not requiring environmental mitigation measures. Sanitary landfill: site operating in compliance with technical control procedures and environmental mitigation measures.

b) Water quality index (IQA) calculated as weighted average of nine parameters. The index varies from 0 to 100. Water classes: "excellent" ( $\leq 79$ ); "good" (51-79); "moderate" (36-51); "poor" (19-36); "very poor" ( $\leq 19$ ). The last two categories refer to unsafe drinking water.

Source: ANA (2013), *Conjuntura dos Recursos Hídricos no Brasil*; IEA (2014), *IEA World Energy Statistics and Balances* (database); MCTI (2014), *Estimativas anuais de emissões de gases de efeito estufa no Brasil*; MMA (2014), *Inventário Nacional de Emissões Atmosféricas por Veículos Automotores Rodoviários, 2013*; MMA (2012), *National Plan for Solid Waste*; UNSD (n.d.), UNSD Environmental Indicators.

### **Air quality**

Air pollution has been reduced in all major cities, but peak concentrations of small particles have grown and regularly exceed national air quality standards (IBGE, 2013). Air pollution causes high economic, social and health costs in major metropolitan areas. Brazil is revising its national air quality standards in accordance with World Health Organization guidelines. The states are in charge of air quality regulation and monitoring, but only 12 states had some type of monitoring system installed in 2012, and few of them provide consistent, accessible data. Less than 2% of municipalities monitor air quality.

### **Waste management**

Municipal waste generation has grown with rising living standards and urbanisation. The share of the population with access to waste collection services has increased, but only about half the population has access to such services in rural areas. As in many emerging economies, landfilling is the primary waste disposal method (Figure 1). The 2010 National Solid Waste Policy (PNRS) established key principles and directives for sound waste management that are compatible with OECD standards. However, the PNRS implementation is challenged by a lack of consistent waste data and capacity gaps at the municipal level (Section 2). Federal government support for landfill construction has helped reducing the amount of waste disposed of in non-sanitary landfills, although Brazil fell short of its national target to close all uncontrolled landfills by 2014.

The PNRS also introduced a “reverse logistics system”, an approach similar to the extended producer responsibility systems operating in most OECD countries. It requires all manufacturers, distributors and retailers of pesticides, batteries, tyres, lubricating oils, fluorescent lamps and electronic devices, and their components, to recover these products at the end of their useful life. Insufficient recycling infrastructure and limited municipal capacity for separate waste collection are the main bottlenecks in implementation of these extended producer responsibility programmes. The federal government has encouraged the formation of co-operatives of waste pickers, who are key players in the waste recovery business, thereby linking environmental and social objectives. However, composting and recycling remain very limited.

### **Biodiversity conservation and sustainable use\***

Brazil is the world’s most biodiverse country. It remarkably expanded the land area under environmental protection in the 2000s, which has been crucial in combatting deforestation. The deforestation rate drastically declined in the Amazon from its latest peak in 2004, although pressures remain high in some other regions, notably the tropical savannah (Section 4). In 2014, official protected areas covered about 17% of the territory. Additional terrestrial areas are protected within indigenous lands and in private lands that comply with the Forest Code requirements. The code requires landholders to set aside a share of their land for forest and soil conservation and restoration, including along water bodies and sensitive areas (Section 4). Overall, these areas cover more than 40% of the national territory, or more than twice the surface within official protected areas. This makes Brazil’s protected area system one of the world’s largest. The share of total area and the degree of protection vary across regions and ecosystems, however. Work is ongoing to extend the marine areas under protection from the current 1.5% of territorial waters and exclusive economic zone to 5% by 2020 (Section 5).

\* See Sections 4 and 5 for details.

## Water resources

Brazil is endowed with 12% of the world's freshwater resources, about 70% of which are located in the Amazon basin. It has introduced modern instruments of integrated water resource management. Water resource plans, prepared at the national, state and river basin levels with broad stakeholder participation, lay out priorities, programmes and projects. However, such plans cover only half the territory and, where they exist, are poorly implemented and fail to guide water resource allocation (OECD, 2015a).

Water use permits (for abstraction and other uses) are issued by national or state water agencies, depending on the jurisdiction of the water body. Federal and state water permit systems could be better integrated to improve water management in shared river basins. Water abstractions, especially for agriculture, have dramatically increased since 2000 (Figure 1). Water scarcity has become an economic and social constraint in the more populated and economically developed areas in the South-east region due to climatic factors and inefficient water use (ANA, 2013). Obsolete and undersized infrastructure is a major cause of high losses in water distribution (Section 3).

In an approach that is fully consistent with best practices in OECD countries, Brazil has introduced a system of quality classification of surface water bodies that is based on their main uses and establishes quality standards corresponding to each use class. Water quality is low in many densely populated urban areas, a fact that is often related to insufficient infrastructure for sewage collection and treatment (Figure 1). While access to potable water in urban areas is now almost universal, 56% of the urban population had access to sewage collection systems in 2011, with large regional variations. In some areas, environmental and health impacts resulting from insufficient sanitation and high levels of fertiliser and pesticide use are significant (MMA, 2010; 2015).

### Recommendations on climate change policy and air, water and waste management

#### Climate change policy

- Rapidly implement the sectoral programmes to mitigate GHG emissions and speed up the development of the SMMARE system to monitor results; ensure that effective measures are replicated and scaled up.
- Further advance the development and implementation of the climate change adaptation plan with the involvement of all sectors, levels of government and stakeholders; ensure that the strategy adequately reflects economic, social and environmental impacts, including on biodiversity and water availability and quality.

#### Air pollution, water and waste management

- Develop an effective nationwide air quality monitoring system, with consistent methodologies and data collection across states.
- Establish consistent and compatible criteria for water allocation and ensure that wastewater discharge limits are set in accordance with use-based water quality standards.
- Strengthen solid waste management by:
  - ❖ better enforcing hazardous waste management regulations to eliminate the disposal of hazardous waste in municipal landfills without prior treatment;
  - ❖ establishing the National Solid Waste Management Information System, as required by law, and using it to facilitate implementation of “reverse logistics” programmes for key product waste streams.

## 2. Environmental governance and management

### **Multilevel environmental governance framework**

Since the 1980s, Brazil has developed a comprehensive environmental policy and institutional framework. The main nationwide policy-making body is the National Environmental Council (CONAMA), established in 1981, a high-level advisory and deliberative committee that brings together representatives of all government levels and principal stakeholders. The institutional capacity and staff of the federal Ministry of the Environment (MMA) have grown remarkably over the last ten years. The MMA has gradually come out from its long-standing isolation from sectoral policy making and has increasingly engaged in constructive dialogue with other line ministries. This has led to recent progress in integrating environmental issues into the economic and social agendas. Nevertheless, as in many other countries, an institutional culture of multiple silo-type ministries still prevails. Ensuring high-profile leadership or co-ordination would help improve policy coherence and enable a whole-of-government approach to sustainable development.

All states and nearly all municipalities with populations over 100 000 have established functioning environmental institutions, although their level of development varies considerably. For instance, about a quarter of municipal environmental councils were inactive in 2013 (IBGE, 2014). Many state agencies face a significant challenge to attract and retain qualified technical staff. The Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) has tended to play a supplemental role to the state agencies, especially where institutional capacity is limited, such as in the North and North-east.

The federal and state governments have invested in capacity building, but there still is a need for better information on state and local environmental policy implementation. The associations of state (ABEMA) and local (ANAMMA) environmental agencies have undertaken activities to promote co-operation and information exchange among member institutions. The National Water Management Pact is a good example of a co-operation strategy involving authorities at all administrative levels, one that could help improve dialogue and capacity across government levels and serve as a model for other environmental policy areas.

The combination of Brazil's high economic and social heterogeneity and its decentralised federal governance system creates significant multilevel governance challenges. Progress was made with Complementary Law 140/2011 and Presidential Decree 8437/2015, which clarified the boundaries of federal, state and local jurisdiction over environmental issues. However, implementation and co-ordination challenges remain. Co-ordination bodies are abundant but often lack the decision-making tools, capacity and resources to get to grips with vested institutional interests. Addressing their weakness and the low capacity of most subnational authorities would help establish a nationwide level playing field in setting and enforcing environmental requirements.

### **Financing of environmental institutions**

In the Treasury's budget classification by government function, allocations for environmental management grew by 48% over 2010-14 to about 0.4% of the federal budget (Senado Federal, 2015). In 2014 the Ministry of Planning, Budget and Management launched a project to track environment-related spending across the government, in co-operation with the Institute for Applied Economic Research. This is of particular importance because

the MMA budget is relatively small and other ministries and agencies contribute a large part of public environmental expenditure. This initiative will help improve understanding of the effectiveness and efficiency of public resource allocation; it should be continued with rigour and, over time, extended to state and municipal spending.

The two largest federal environment-related funds (the National Climate Change Fund and the Amazon Fund) have sound monitoring systems and have been effective in securing resources for environmental projects, including international finance. Most states and large municipalities operate environmental funds, partly fed by revenue from environmental fines; by comparison, in most OECD countries revenue from fines goes to the government budget, as the incentive to collect revenue may hamper actions to prevent non-compliance. Brazil also uses part of its oil and gas revenue to fund environmental and climate mitigation objectives. Earmarking resources to funds for environmental purposes may be necessary to secure reliable, sufficient resources, but can reduce the flexibility and efficiency of revenue allocation.

### **Environmental legislation**

The Brazilian Constitution recognises the people's right to an ecologically balanced environment. Since the adoption of the 1981 National Environmental Policy Law, Brazil has developed a comprehensive and advanced environmental legislation framework at the national level and in most states. There are, however, implementation gaps to be addressed. The stringency of environmental requirements varies substantially across jurisdictions, reflecting local priorities and capacity constraints. This raises concerns about potential "environmental dumping", in which highly polluting industries would establish facilities in states that lack the capacity to set and enforce environmental regulations.

### **Environmental licensing, compliance and enforcement**

Brazil does not have an integrated system of land administration across the three levels of government. Unclear definition of property rights for both public and private holders has historically exacerbated problems of unplanned and unauthorised land use, including forest clearing. The recently established Rural Environmental Cadastre (CAR) system is an important step towards addressing environmental aspects of regularisation of rural holdings (Section 4). There is no federal legal requirement for strategic environmental assessment of territorial plans and other development programmes, although some states have made it mandatory and ecological-economic zoning covers more than 70% of the territory. In urban areas, municipal master plans have been required since 2005. They combine but do not integrate individual components on sanitation, transport, housing, etc., and are still rarely implemented.

Environmental licensing (which incorporates environmental impact assessment, EIA) is a crucial regulatory instrument at all government levels. In practice, however, it has become a bureaucratic administrative process without adequate consideration of location, technological alternatives, potential environmental impact and mitigation measures (ABEMA, 2013). While technical and institutional capacity for environmental licensing has improved at federal level, weak institutional capacity of subnational environmental authorities, inadequate project planning and design, and occasional interference of local economic and political interests hinder the effectiveness, timeliness and transparency of the process. The licensing process has increasingly become an arena for wide-ranging discussions on development options and their consequences – environmental, social and others.

Complementary Law 140/2011 and a subsequent presidential decree made the division of licensing responsibility across the three government levels more objective, depending on a given project's scale, location and extent of potential environmental impact. However, a clearer regulation of measures and mechanisms to compensate the environmental impact is needed.

As in other policy areas, various factors contribute to weak law enforcement in many states and municipalities: insufficient human resources limit inspections to responding to incidents; administrative fines are often ineffective due to very low collection rates; and environmental liability is sporadically applied. At the same time, the role of federal and state prosecutors in civil and criminal environmental enforcement has increased, which has helped ensure compliance. Socio-environmental responsibility initiatives in the financial sector are important factors in promoting compliance and good practices. Since 2008 the Central Bank has issued resolutions incorporating socio-environmental concerns in financial activities, including credit restrictions for non-compliers (Section 4). However, businesses often lack enough information and incentives to adopt sustainable practices voluntarily.

### **Environmental democracy**

Public participation is an eminent feature of Brazil's environmental governance, including membership of non-government organisations (NGOs) in multistakeholder decision-making bodies – e.g. government councils and protected areas management committees (Section 5) – mandatory public consultation as part of environmental licensing, and guaranteed citizen access to environmental information and justice. However, the mechanisms for taking account of civil society views in environmental decision making should be strengthened further.

Federal laws provide important guarantees of citizens' access to environmental information. The National Environmental Information System (SINIMA) is responsible for developing a consistent policy directed at the production, collection, systematisation and dissemination of environmental information. Brazil's statistics institute, IBGE, publishes sustainable development indicator reports every two years and the MMA has been working to develop a set of key environmental indicators (the National Panel of Environmental Indicators, PNIA) consolidating available environmental data. Despite these efforts, environmental information remains fragmented, which undermines policy analysis and the public's ability to influence environmental policy development and implementation.

## **3. Greening the economy in the context of sustainable development**

### ***The sustainable development framework***

Brazil has moved up the ranks of the world's largest economies and made considerable progress towards sustainable and inclusive growth. It enjoyed robust economic growth over most of the 2000s, which helped narrow the income gap with OECD countries. Growth has slowed since 2012, however (OECD, 2015b). The large conditional cash-transfer programme Bolsa Família, which is recognised as an international best practice, has helped halve the number of people living in extreme poverty (*bolsa* means grant or stipend). Health service coverage and educational outcome have also improved, but income inequality and territorial disparities are large. Brazil needs to restore strong growth while continuing to address social challenges and enhance conservation and sustainable use of its environmental assets.



## **Recommendations on environmental governance and management**

### **Environmental governance**

- Streamline the multitude of horizontal and vertical co-ordination bodies, with a view to eliminating overlaps and gaps of responsibilities and, ultimately, improving policy coherence and effectiveness; consider establishing a national system for quality control and accountability.
- Build on the associations of state (ABEMA) and local (ANAMMA) environmental agencies to create a network of regulators at all administrative levels and enhance their capacity through exchange of experiences and good practices; consider implementing a programme for strengthening capacity at subnational level.
- Consider replicating multilevel governance mechanisms such as the National Water Management Pact to other environmental policy areas to promote integration and dialogue across levels of government and reduce regional disparities in environmental performance.
- Streamline funds dedicated to environmental management and projects; systematically monitor the use of environmental funds to ensure that it is in line with policy priorities, transparent and cost-effective.
- Develop a uniform system for the collection and management of environmental data, including on environmental law implementation (input, output and outcome indicators) and economic aspects of environmental policies (expenditure and revenue accounts; environment-related goods, services and employment).

### **Environmental licensing, enforcement and compliance**

- Introduce and enforce a legal requirement of strategic environmental assessment of municipal territorial plans and sectoral development programmes, which should be used to integrate the economic, social and environmental aspects of land use.
- Streamline the environmental impact assessment and environmental licensing requirements across and within administrative levels; clarify the boundaries of compensation actions that have socio-environmental objectives and those that pursue social objectives; develop procedural guidance for each stage of the licensing process and build capacity of licensing authorities.
- Strengthen the capacity of environmental inspectors at all government levels, emphasise proactive (planned) compliance monitoring, improve collaboration with federal and state prosecutors and develop broader opportunities for “citizen enforcement” by engaging local communities in compliance monitoring.

Since the early 2000s, Brazil has launched several initiatives to address the economic, social and environmental strands of growth and sustainable development in an integrated manner. These included the 2002 Agenda 21, which has long been considered the national sustainable development strategy, although it lacked implementation mechanisms. Some cash transfer programmes have targeted environmental and social objectives simultaneously, as a significant part of the population, especially in rural areas, depends on the sustainable use of natural resources (Section 4). Some programmes for agriculture, industry, energy and infrastructure development have started to include an environmental dimension. These positive initiatives could be consolidated into a coherent strategic framework for a green economy and sustainable development.

### ***Greening the system of taxes and charges***

In the context of a broader tax reform, there is scope to extend and improve the use of environmentally related taxes and remove potential environmentally perverse tax exemptions and subsidies so as to promote more efficient and sustainable resource use. In 2013, revenue from environmentally related taxes in Brazil accounted for about 2% of total tax revenue and 0.7% of GDP, below the levels observed in most OECD countries.

While fuel prices were deregulated in the early 2000s, between 2006 and 2012 the government kept prices below the world market level. In addition, the rate of the federal fuel tax (CIDE) gradually declined. These implicit subsidies kept petrol prices artificially low and provided no incentive to moderate private car use, while harming the ethanol industry. When petrol and diesel prices were raised in 2012, the CIDE rate was set to zero as a compensating measure.

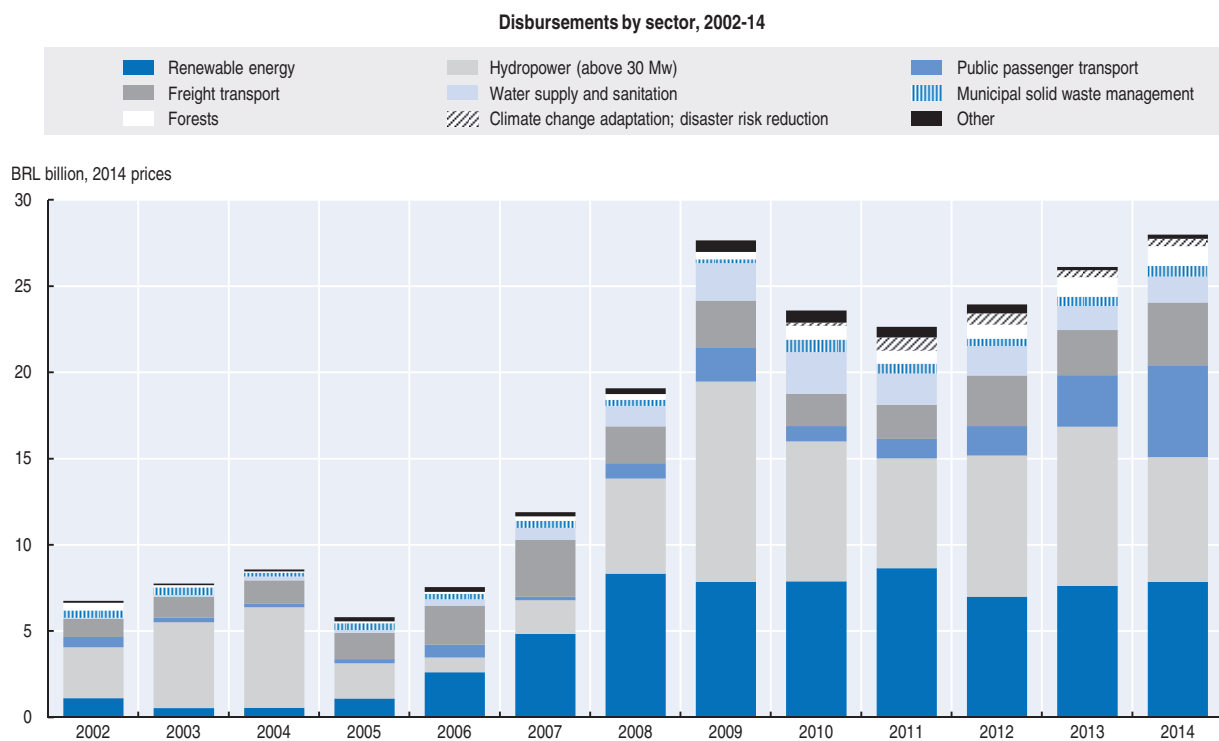
In a welcome move, the government reintroduced positive CIDE rates in early 2015, but rates are not linked to fuels' energy or carbon content. As in most countries, diesel is taxed at a lower rate than petrol despite its higher carbon content and emissions of local air pollutants. Consumption of fuels in sectors such as agriculture and industry remains largely untaxed. The economy-wide effective tax rate on CO<sub>2</sub> emissions is, therefore, one of the lowest among OECD countries and the BRICS group of emerging economies (Brazil, Russia, India, Indonesia, China, South Africa) (OECD, 2015c). The finance ministry has undertaken a comprehensive assessment of carbon pricing options, including a carbon tax and a cap-and-trade system, with a view to providing policy recommendations in 2017. This is a step in the right direction and could build on previous attempts to introduce subnational GHG emission trading systems.

Revenue from vehicle taxes has grown with the increase in vehicle ownership, but tax rates do not consider vehicles' environmental attributes. Reduced purchase tax rates for flex-fuel cars have stimulated sales of these cars, which account for the majority of all passenger cars. Only a few states have implemented water abstraction and pollution charges, but unit prices are low and have had limited effect on decisions about water allocation and use (OECD, 2015a). There are no other charges on natural resource use and pollution.

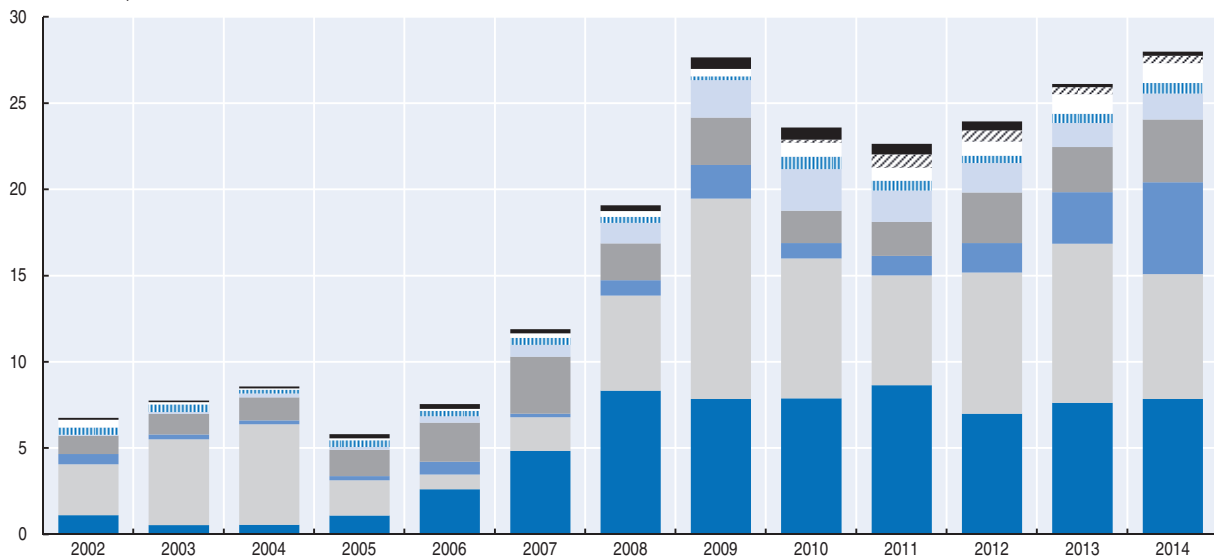

### ***Environment-related investment and financing***

Public investment in infrastructure increased with the 2007 Growth Acceleration Programme and its 2011 successor. This will help sustain growth and improve service delivery. The 2011 programme also included a stronger environmental dimension with increased resources for sanitation, transport and energy. Some investment programmes have considered sustainability criteria and potential climate impacts, although not in a systematic manner.

The Brazilian Development Bank (BNDES), the biggest provider of long-term finance, has stepped up its environment-related lending activities, which accounted for 15% of its total lending in 2014 (Figure 2). The BNDES has also introduced environmental screening for its major lending projects and some sectors with potentially high environmental impact (e.g. soya, sugar and ethanol, meat processing, fossil energy). However, weaknesses in project planning, design, implementation and monitoring have delayed infrastructure delivery, discouraged private-sector engagement and resulted in federal money remaining unspent. This is especially true for environment-related infrastructure such as for sanitation and urban transport, which is the responsibility of local governments, as well as for large infrastructure projects in sensitive areas, such as the Amazon.

Figure 2. **BNDES environment-related disbursements have increased significantly**

BRL billion, 2014 prices

StatLink  <http://dx.doi.org/10.1787/888933279332>

More people now have access to electricity, clean water, sanitation and waste management services. Yet coverage and quality of infrastructure need to be expanded and improved, particularly for wastewater treatment, sanitary landfills and recycling (Section 1). Inadequate pricing is among the impediments to extending water and waste infrastructure and services. Most municipalities do not charge for waste collection or do so through property taxes, which do not provide any incentive to reduce waste generation or sort for recycling. On average, water tariffs allow coverage of operational and maintenance costs but a very limited share of new infrastructure investment, and there are wide variations in tariffs and operation efficiency across municipalities and service providers (MCid, 2014). As in other Latin American countries, a large share of distributed water does not generate revenue. Revenue is lower in poorer municipalities, partly due to social tariffs applied to low-income households; this may discourage investment in extending infrastructure where it is most needed. Alternatively, cash transfer programmes could be used to compensate low-income households.

### **Investment in clean energy and sustainable transport**

In 2014, Brazil was the world's seventh largest investor in renewable energy sources (BNEF, 2015). The Energy Expansion Plan 2022 envisages maintaining the reliance on renewables (Section 1). Investment has focused on large hydropower plants, which received most of the BNDES's environment-related lending in 2008-14 (Figure 2). Various forms of support, including renewables-technology-specific power purchasing auctions,

have helped increase energy supply from sources other than large hydro, especially wind. Local content rules, a condition for BNDES financing, have led to the creation of a wind power industry in Brazil, although this form of industrial protection could harm the sector's competitiveness in the long run.

Brazil has encouraged the development of large-scale sugarcane ethanol production and the use of ethanol to power road vehicles since the 1970s, including by means of mandatory blending quotas and favourable taxation. As a result, biofuels accounted for 17% of fuels used in road transport in 2012, by far the world's highest share. In the early 2010s, the government and the BNDES renewed investment support to the ethanol industry and sugarcane production in response to declining productivity in the sector, which was partly due to the artificially low price of petrol.

Brazil launched a National Energy Efficiency Plan in 2011 and set a countrywide energy saving target to 2030. The state electricity company, Eletrobras, has implemented energy demand management programmes in industry and municipalities. Regulations and labelling programmes have improved the energy efficiency of appliances and equipment. However, the approach to energy efficiency and demand management has been piecemeal. Brazil can gain from systematically integrating energy efficiency criteria in sectoral policies, including for housing, urban planning and transport.

Passengers and freight mostly travel on roads in Brazil. Insufficient public transport infrastructure and rising user costs, in combination with relatively low taxation of vehicle ownership and use, have contributed to exacerbating urban car traffic. The 2011 Growth Acceleration Programme included expansion of the long-distance and urban rail networks, which is welcome. More emphasis could also be given to bus rapid transit systems, which have been successfully operating in some cities, such as Curitiba, and were launched in Rio de Janeiro and Brasília in 2014. They could help reduce congestion in cities and along road networks, with benefits including fewer accidents and lower GHG and air pollutant emissions.

### ***Eco-innovation and environmental goods and services***

Eco-innovation is among the priorities of Brazil's innovation strategy. Brazil has leading innovative firms and high expertise in selected high-technology fields such as renewables and agro-technology. Green research and development (R&D) expenditure is estimated to account for about 3% of total R&D expenditure (Frischtak, 2011). Eco-innovation performance has improved and Brazil has been developing a specialisation in environmental technology compared to other BRIICS economies. The number of patents in environment- and climate-related technology has grown, accounting for about 9% of all patents filed in Brazil in 2009-11 (the BRIICS average was 7.8%). Brazil has generated the world's third largest amount of certified emission reduction credits under the Clean Development Mechanism, which has been a key driver of technology transfer and has also encouraged domestically driven innovation.

Brazil would benefit from improved coherence of industrial, labour market and innovation policies and enhanced co-operation between the government, research institutions and the business sector. Eco-innovation faces barriers similar to those facing general innovation, including weak science-industry links, skill gaps, regulatory obstacles, high patenting costs and a complex system of economic and fiscal incentives. Together with public support to R&D, some demand-side policy measures have recently emerged,

including sustainable public procurement, labelling programmes and policies that set sectoral environmental performance targets. However, environmental labelling is costly and sustainable products account for a negligible share of government purchases (MMA, 2015). The 2015 Biodiversity Framework Law is expected to facilitate innovation and industrial activity based on the fair use of genetic assets and traditional knowledge (Section 4).

The environmental goods and services sector seems to have grown faster than the overall economy (ABDi, 2012). Estimates indicate that it could be a significant source of growth for the country (1% to 7% of GDP). However, various forms of protection of national businesses (e.g. local content requirements and high import duties) limit competition, raise technology costs and discourage innovation and diffusion of more efficient, cleaner technology, goods and services. Brazil's leading companies invest only 1% of turnover in sustainable technology, and small and medium-sized enterprises are likely to invest even less (AHK, 2009). Nevertheless, increased adoption of social corporate responsibility practices and environmental management systems shows that business awareness of environmental issues has improved.

### **Development co-operation**

Brazil has increased its expenditure on development co-operation and is one of the most active partners in triangular co-operation. While its co-operation has traditionally focused on health, agriculture and education, the number of environmental projects has expanded, and prospects of this growth accelerating in the near future are good. Brazil is engaging with other countries to share its expertise in forest and land-use monitoring; and the government plans to increase south-south co-operation on forest recovery (Section 4).

#### **Recommendations on greening the economy in the context of sustainable development**

##### **Greening the system of taxes and charges**

- Reform the system of environmentally related taxes and charges, possibly within the context of a broader fiscal reform, including:
  - ❖ maintaining positive rates for the federal CIDE tax on petrol and diesel and adjusting them to reflect fuel carbon content and emissions of local air pollutants; applying the CIDE to fuels used for aviation and stationary purposes (e.g. industry);
  - ❖ introducing taxes on pollution (e.g. air emissions), waste (e.g. packaging materials) and resource use (e.g. minerals), and aligning vehicle taxation to environmental performance;
  - ❖ ensuring that water abstraction and pollution charges reflect scarcity and pressures on the environment and are consistently applied across river basins and throughout the country (as required by law).
- Pursue the assessment of carbon pricing options; consider testing GHG cap-and-trade systems at state level to gain the experience needed to implement a countrywide system linked to international carbon markets.

### **Recommendations on greening the economy in the context of sustainable development (cont.)**

#### **Investment in environment-related infrastructure and services**

- Systematically integrate environmental objectives into sectoral policies and public investment programmes, which should feature environmental sustainability criteria for implementation and indicators to monitor progress.
- Simplify administrative procedures and support capacity development to improve the execution of environment-related infrastructure investment programmes, especially at local level; encourage stronger intermunicipal collaboration to achieve economies of scale in providing sanitation and waste treatment services.
- Extend the use of user charges for water supply, sanitation and waste services and enforce their collection, with a view to encouraging efficient use of resources, increasing cost recovery, improving investment financial viability and leveraging private sector resources; use social transfers to ensure that low-income households have adequate access to these services.
- Strengthen measures to improve energy efficiency by introducing energy standards for buildings and appliances, integrating them into social housing programmes and using mandatory fuel economy standards and labelling to promote a shift towards more efficient vehicles.
- Continue to scale up investment in railways and urban public transport systems; consider extending the use of instruments such as road tolls, congestion charges, parking fees and restrictions on car circulation to moderate the use of private vehicles.

#### **Eco-innovation and environmental goods and services**

- Stimulate the production and diffusion of environmental technology, goods and services by:
  - ❖ raising awareness about best practices and available technology, particularly in small and medium-sized enterprises;
  - ❖ facilitating access to finance for investing in environmental, renewables and energy-saving technology;
  - ❖ monitoring the effects of local content rules on the long-term competitiveness of the emerging environmental technology industry (e.g. wind and solar);
  - ❖ regularly updating the catalogue of sustainable products for green public procurement, and training procurement managers;
  - ❖ further streamlining environmental labelling initiatives.

## **4. Conservation and sustainable use of biodiversity\***

### **Brazil's biodiversity: state, trends and pressures**

A megadiverse country, Brazil is home to around one-tenth of all known species and more endemic species than any other country. It is host to six terrestrial ecosystems, or biomes (Amazon, Cerrado, Caatinga, Atlantic Forest, Pantanal and Pampa) and various coastal and marine ecosystems.<sup>1</sup> The Amazon, the world's largest rainforest, occupies nearly half of Brazil's territory. As in most emerging economies, infrastructure development, agriculture, population growth and urbanisation are the main pressures on

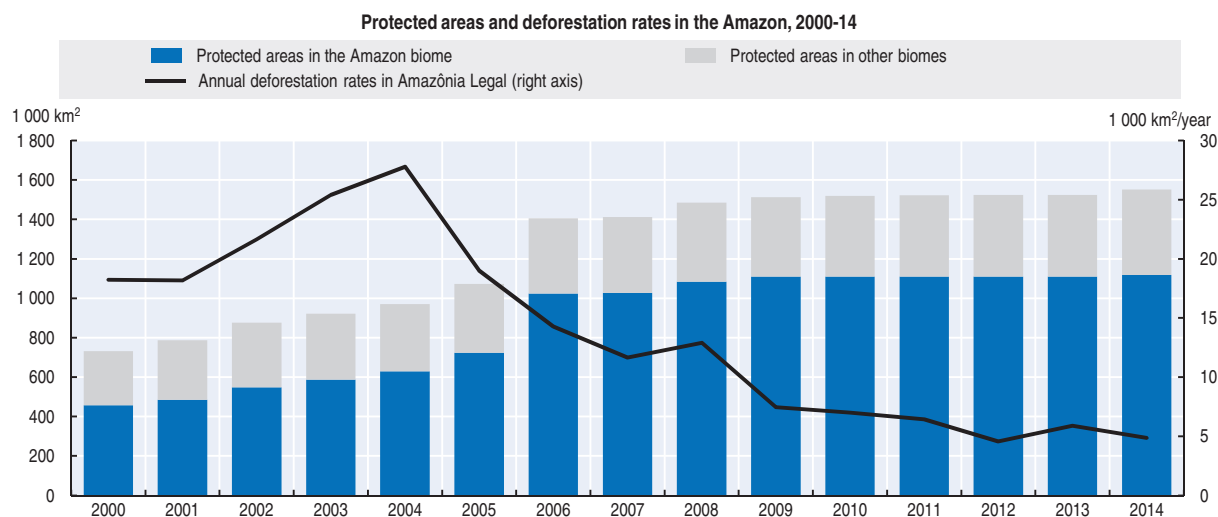
\* See Section 5 for details on protected areas.

biodiversity (MMA, 2015). Biodiversity conservation status varies widely across regions and states, being generally poorer in the South and South-east regions and along the coast, where most of the population lives.

Brazil has made impressive progress in reducing deforestation. In 2014, after peaking in the mid-2000s, the annual deforestation rate in the area known as *Amazônia Legal*<sup>2</sup> was 75% below the average for the previous 10 years (Figure 3). Brazil is, therefore, likely to overshoot its target of reducing deforestation in the region by 80% by 2020. However, progress has been uneven across the states in the region, and the current pace still means forest loss equivalent to the size of Slovenia (or the Brazilian state of Sergipe) every four years. Deforestation rates have also declined in most other biomes in recent years, but pressures remain high in the Cerrado. Overall, total forest area has decreased by about 5% since 2000. Unclear land tenure has historically exacerbated deforestation pressures from illegal logging and agriculture and pasture expansion.


Action to protect threatened species has increased and the conservation status of more than 100 species has improved since the previous assessment (MMA, 2015). In 2012, about half of threatened fauna species were protected under a conservation action plan, and federal protected areas now cover nearly 60% of threatened flora and fauna species. Yet the 2014 lists of threatened flora and fauna species indicate that over 45% of plant species are threatened, especially in the Atlantic Forest and Cerrado biomes, as are nearly 10% of fauna species. Several coastal and inland fish stocks are fully exploited or overexploited (MMA, 2015).

Figure 3. **Expanding protected areas has helped reduce deforestation in the Amazon**



Note: The *Amazônia Legal* encompasses the Amazonian forest (about 4.1 million km<sup>2</sup>) and transitional vegetation (1 million km<sup>2</sup>).

Source: INPE (2015), "Projeto PRODES: Monitoramento da floresta Amazônica Brasileira por satélite"; MMA (2015), *Cadastro Nacional de Unidades de Conservação*.

StatLink  <http://dx.doi.org/10.1787/888933279342>

### **Improving the knowledge base for biodiversity policy**

Brazil has made impressive progress in improving the knowledge base on species and ecosystems and in monitoring the state and trends of biodiversity. However, the abundant biodiversity-related information remains fragmented and not always consistent. In 2010, the Ministry of Science and Technology launched the online Information System on

Brazilian Biodiversity (SiBBR), in an attempt to systematise this information and make it more accessible for research and policy design.

Brazil is a world leader in monitoring deforestation via satellite imaging, which has been a crucial factor in reducing forest clearing in the Amazon. A nearly real-time monitoring system alerts authorities if deforestation and forest degradation occur in the region. Satellite deforestation monitoring has been implemented for the other biomes, too, but it is less developed and data are not fully compatible across systems. Forest fire detection systems cover the entire country.

In 2013, the MMA launched the Brazilian Natural Capital Initiative as part of Brazil's commitment to develop a national TEEB (The Economics of Ecosystems and Biodiversity) process. This initiative could help fill Brazil's gap in economic valuation of biodiversity and build consensus on the benefits of maintaining functioning ecosystems. This, in turn, would contribute to raising the political and social support that is needed to mainstream biodiversity effectively in the development agenda.

### ***Policy framework for biodiversity conservation and sustainable use***

Since the mid-2000s, Brazil has strengthened its institutional, policy and legislative frameworks for biodiversity conservation and sustainable use. There has been a gradual shift from a strict fence-and-protect and enforcement approach to a sustainable development approach that identifies biodiversity priority regions and recognises the role of rural, traditional and indigenous communities in maintaining the provision of ecosystem services.

In 2013, the National Biodiversity Commission adopted 20 ambitious national biodiversity targets to 2020, aligned with the Aichi Targets under the Convention on Biological Diversity (CBD). It also established a multistakeholder panel, PaineBio, to define indicators to monitor progress. A midterm assessment indicates that Brazil is on the right track to achieve most of its targets, although additional efforts are required (MMA, 2015). Several states have developed biodiversity strategies and action plans, but ensuring consistency and synergy with federal biodiversity policies is challenging.

Overall, there has been a proliferation of biodiversity-related plans and programmes since 2000, often with overlapping objectives. It is unclear to what extent they have been implemented or yielded the expected results. With few exceptions, implementation of biodiversity policies and plans is not systematically monitored, and their effectiveness, costs and benefits are rarely evaluated.

### ***An integrated strategy to combat deforestation***

Understandably, Brazilian biodiversity policy has focused heavily on combating deforestation. In 2004, in response to rising deforestation rates in the Amazon, the government launched the Action Plan for Prevention and Control of Deforestation in Amazônia Legal (PPCDAm). The plan has effectively brought the fight against deforestation into other sectoral agendas, thanks to high-profile co-ordination by the Executive Office of the Presidency (Casa Civil) and the assignment of implementation responsibilities to 13 ministries. Currently in its third phase, the PPCDAm is based on a coherent set of actions such as establishment of protected areas (Section 5), land tenure regularisation (including the Terra Legal programme), advanced monitoring systems, strict enforcement, and promotion of sustainable natural resource use. Complementary instruments such as embargos and credit restrictions for illegal deforesters have spurred enforcement effectiveness.



The PPCDAm is widely recognised as an effective strategy, which can serve as a model for other countries. It has greatly helped reduce deforestation in the Amazon (Figure 3), although other factors may have contributed, including declining prices of agricultural products and voluntary private sector engagement. Building on the success of the PPCDAm, the government launched a similar programme to control deforestation in the Cerrado biome. In addition to strict monitoring and enforcement, further reducing deforestation will increasingly require making sustainable agriculture and forest management more attractive than illegal logging and land grabbing, and ensuring that sustainable practices provide a viable income source for traditional communities (CEPAL et al., 2011).

Acknowledging this need, since 2006 the government has granted concessions for sustainable harvesting of timber and non-timber forest products. Concessions still cover less than 1% of the eligible forest area, mainly because of red tape, high transaction costs, lack of infrastructure and land tenure conflicts. Many rural communities do not have the knowledge or means to adopt sustainable forest practices or to compete in concession processes.

Funding from international and bilateral co-operation has helped finance the PPCDAm and other biodiversity-related programmes and has added implementation capacity to the government machine. Much of the international finance is used through extrabudgetary funds, including the innovative Amazon Fund. Established in 2008 and managed by the BNDES in co-ordination with the MMA, the fund invests in deforestation prevention and sustainable forest use, thereby contributing to reducing GHG emissions. Norway is the largest donor, followed by Germany. Between 2009 and early 2015, the fund accumulated more than USD 970 million and supported over 70 projects. Through the Amazon Fund, Brazil has received about half the total approved international finance from Reducing Emissions from Deforestation and Forest Degradation (REDD and REDD+) (Norman et al., 2014). In June 2014, it was the first country to submit its forest reference emission level for payments under REDD+ as required by the 2013 Warsaw Framework. A national REDD+ strategy has been under discussion since 2010.

The business sector has contributed to the combat against deforestation in the Amazon through the Soya Moratorium and the Beef Slaughterhouse Pact. The moratorium involves a group of large companies that have voluntarily agreed to stop using soya beans grown on Amazonian forestland that has been illegally cleared since 2008. The moratorium has proved effective, as farmers tend to adapt to market demand. There is scope to further engage the business sector in forest conservation and restoration and, more generally, in biodiversity conservation and sustainable use.

### ***The new Forest Code and the Rural Environmental Cadastre***

In 2012, Brazil approved the new Forest Code, which replaced and updated the 1965 code. The code had traditionally been the key legal instrument to protect native vegetation on private property and to regulate land use. It required landholders to set aside a share of their land for forest and soil conservation and restoration (so-called Legal Reserves and Permanent Preservation Areas). The code was hardly enforced, however, with considerable areas being deforested illegally. In response, the new code, while criticised as indulgent towards commercial interests, introduced potentially more effective enforcement instruments, which may result in a better level of protection. The new Forest Code aims to reconcile the objectives of preserving biodiversity and forests and of ensuring a good business environment for agriculture, a key sector of Brazil's economy.

In particular, the new code introduced the Rural Environmental Cadastre (CAR) to improve monitoring of, and compliance with, forest conservation requirements on rural lands: landholders must register their lands and set-aside areas in the cadastre by May 2016, and CAR registration will be a condition for access to rural credits as from October 2017. Rural plots that do not comply with the land set-aside obligations will have to join state environmental regularisation programmes. The system uses high-resolution satellite images to localise and register each rural parcel.

The CAR implementation is on track: as of April 2015, 53% of the target area had been registered. The federal government has invested in establishing the necessary information system and in building capacity at state level, as states are responsible for implementation of the cadastre. Strict enforcement of the new code is expected to greatly help reduce deforestation rates further. Although the cadastre is not designed for regularising land property rights, the authorities responsible for rural development and settlements can use the geo-referenced information about the location of rural plots (as declared by their owners or holders) to clarify land tenure.

The new Forest Code foresees to complement cadastre registration with an innovative system of tradable forest quotas called Environmental Reserve Quotas (CRAs). In practice, landholders who did not meet their set-aside obligations (prior to 2008) can either restore the tree cover or purchase an equivalent quota amount. Quotas are issued for area maintained as native vegetation in excess of the set-aside requirements. Offsetting is possible only within the same biome and, possibly, the same state. This system creates demand for forested lands and encourages forest conservation. Estimates indicate that the past deficit of compliance with forest conservation obligations is large (Soares-Filho et al., 2014). As forest restoration is costly, especially for small rural holders, the quota system could be a cost-effective way of ensuring compliance. The MMA is considering how to address the risk that only low-opportunity-cost areas are competitive in the market, leading to increased conservation of areas that do not necessarily have the highest biodiversity value.

The National Plan for Native Vegetation Recovery (PLANAVEG), developed by the MMA and currently under public consultation, aims to promote large-scale forest restoration on 125 000 km<sup>2</sup> within 20 years. The MMA expects the plan to generate over 190 000 direct jobs in rural areas. Meeting the restoration targets is likely to require significant financial resources and innovative finance mechanisms, such as green bonds for restoration investment. The CAR will allow to identify high-biodiversity-value areas and to prioritise restoration actions.

### ***Payments for ecosystem services and conditional cash-transfer programmes***

While the regulatory approach has traditionally prevailed, the use of economic instruments has been broadened. Most such instruments aim to reward biodiversity-friendly actions, such as good agricultural practices or sustainable forest use. The use of charges and fees, such as water charges and entrance fees to protected areas, is very limited (see also Sections 3 and 5).

Brazil has implemented several federal and state programmes of payments for ecosystem services (PES) and income support for rural communities. The Water Producer Programme, launched in 2011 by the National Water Agency and replicated by some states and municipalities, financially compensate investment in soil and water protection in river basins that provide water resources to a large population. Programmes such as Bolsa

Floresta and Bolsa Verde provide payments to extremely poor households in rural and forest communities to compensate them for environmental conservation activities and support their income. Bolsa Floresta, in Amazonas state, has helped control deforestation, although it is implemented mostly in areas experiencing little deforestation pressure (Börner et al., 2013).

Bolsa Verde is a federal programme providing payments for adoption of environmental practices and technical training to support beneficiaries in meeting their conservation commitments. It is seen as a potentially efficient way to curb deforestation, with low payments per hectare of avoided deforestation. However, implementation is complex and complementary training activities are insufficiently developed (CGU, 2014). Developing monitoring mechanisms and ensuring a link with the Rural Environmental Cadastre would help improve effectiveness and reduce management costs for Bolsa Verde and the existing PES programmes. An overarching federal PES law has been under parliamentary discussion since 2007 and could provide the basis for expanding and improving the use of such programmes.

### **Access to genetic resources and benefit sharing**

Brazil is home to hundreds of indigenous, *quilombola*<sup>3</sup> and other traditional communities whose residents have considerable knowledge of how to use plant and animal species. This underlines the importance of ensuring access to genetic assets and fairly sharing the benefits derived from them. Brazil signed the Nagoya Protocol on Access and Benefit Sharing (ABS)<sup>4</sup> in 2011, and is discussing its ratification. After more than a decade of a transitory regime and years of debate, in May 2015 Brazil approved a comprehensive Biodiversity Framework Law. The law aims to overcome the bottlenecks associated with the previous ABS regulation, which had severely restricted access to genetic resources for both commercial and scientific purposes. The new law reduces the administrative burden, improves participation of indigenous groups and traditional communities in decision making and creates a fund for benefit sharing. It has many potential benefits, including generating innovation, business opportunities and additional resources for conservation and sustainable use of biodiversity, for example in protected areas and indigenous lands. It could encourage like-minded African and Asian countries to adopt similar ABS regulations.

### **Mainstreaming biodiversity consideration in agriculture, fishery and energy policies**

Brazil is a major agricultural producer and exporter. Since the mid-2000s, the government has increased its focus on encouraging adoption of sustainable agricultural practices. Access to concessional rural credits is linked to environmental compliance. Some programmes target small family farms, organic farming and sustainable production practices; an example is the Low-Carbon Agriculture programme. Organic farming accounts for a very small share of agricultural output, however, and less than 1% of the agricultural land area.

Overall, support to farmers is low compared to OECD and other BRIICS economies, but it is mostly tied to production based on conventional practices (OECD, 2013), with potentially negative impact on soil and water. By stimulating production and input use, and thereby agricultural intensification and expansion, these support programmes risk increasing pressures on natural resources and encouraging deforestation. The rural land tax, although not very significant, also incentivises agricultural production over

conservation, as it is lower for agricultural land. In addition, fertilisers and pesticides benefit from some tax exemptions. This has contributed to their growing use, which has health and environmental effects. The use of unauthorised pesticides is also high, and, unlike in most OECD countries, regulations do not require periodic review and renewal of pesticide licences (MMA, 2015).

Brazil's fishery management model integrates environmental sustainability and social inclusion concerns. Several measures aim to limit the environmental impact of fishing, but no formal environmental licensing of fishery activities is required. Fish catches have increased and pressures on stocks are exacerbated by resource conflicts between artisanal and industrial fishing. Most fishing is carried out by obsolete fleets and very often directed at fish stocks that are already heavily exploited. Further increasing aquaculture production could contribute to supplying seafood and fish at lower costs to the population, thereby reducing pressure on natural fishery resources. However, its potentially negative impact on aquatic ecosystems should be taken into account.

Hydropower will continue to be a major energy source, but its expansion is constrained by location: most currently available potential is located in the Amazon, which raises difficulties with environmental licensing and public acceptance. Efforts are being made to develop new approaches and techniques, including run-of-river projects in suitable conditions, as development of dams for large hydro can have an adverse impact on river ecosystems and local communities. It can also encourage road construction, migration and urbanisation, further increasing pressures on native vegetation (Barber et al., 2014). Like all infrastructure projects, hydropower plants are subject to environmental licensing and impact assessment (Section 2). Brazil would benefit from adopting a more integrated and strategic licensing process at river basin level, as well as from a clearer quantification of the impact of hydropower on biodiversity and of associated compensatory measures.

## 5. Protected areas

### ***The expansion of the protected area system***

Protected areas are a cornerstone of biodiversity policy in Brazil. In 2003-08, Brazil accounted for over 70% of the global new terrestrial area placed under environmental protection. The National System of Protected Areas (SNUC), established in 2000, laid the groundwork for this remarkable expansion of official protected areas, or “conservation units” as they are known in the country. It consolidated the pre-existing highly fragmented assortment of federal, state, municipal and private protected areas into one consistent framework. It introduced 12 management categories of protected areas, divided into two groups: strict protection areas, with the primary objective of biodiversity conservation; and sustainable use areas, which permit human settlement and natural resource use in accordance with sustainable management plans. In 2006, the MMA set up the National Register of Protected Areas (CNUC), a database collecting a wide range of biodiversity and management data for each official protected area, although information is often incomplete.

Between 2000 and early 2015, the number and extent of terrestrial protected areas in the SNUC more than doubled. In March 2015, 1 940 protected areas covered 17.2% of Brazil's terrestrial area and inland waters. About two-thirds of the protected area is in the sustainable use categories, reflecting the objective of bridging biodiversity conservation

## **Recommendations on conservation and sustainable use of biodiversity**

### **Knowledge base and evaluation**

- Build on the Information System on Brazilian Biodiversity to compile, consolidate and systematise existing and new biodiversity-related information and make it more accessible for research and policy design and evaluation; ensure that the system is regularly and timely updated.
- Continue to develop satellite-based monitoring systems that detect forest deforestation and degradation and cover all biomes, especially the Cerrado, Caatinga and Pampa, where most vegetation clearing is expected; ensure that the systems generate up-to-date and compatible data series.
- Pursue the Brazilian Natural Capital Initiative; conduct a national ecosystem assessment at the earliest opportunity to improve knowledge of the values of biodiversity and ecosystem services and of the risks associated with their loss; ensure that the values of ecosystem services are integrated in national accounts and in policy design and evaluation.

### **Policy framework**

- Maintain the policy focus on combatting deforestation and clarifying land tenure, and extend it to all the terrestrial biomes and to marine, coastal and inland water ecosystems.
- Streamline the multitude of biodiversity-related plans and programmes with a view to eliminating overlap and duplication of efforts and increasing cost-effectiveness; systematically evaluate the implementation of policies and measures in terms of results, costs and benefits, and revise policies and programmes accordingly.

### **Forest conservation, restoration and sustainable management**

- Strengthen implementation of the Rural Environmental Cadastre (CAR) by providing economic incentives to encourage cadastre enrolment, promote compliance and support sustainable management and restoration of set-aside areas; build on the CAR information system to improve compliance monitoring, landscape planning and policy priority setting.
- Support the development of state-level environmental regularisation programmes and enhance implementation capacity of states and municipalities.
- Consider adjusting the Environmental Reserve Quota system to allow quota exchanges within the same priority areas, in terms of biodiversity value; systematically monitor the functioning of the system and allow for the adjustments necessary to achieve its forest preservation and restoration objectives.
- Scale up support for sustainable forestry and farming practices, including in protected areas, by providing training and technical assistance to rural and traditional communities and small farms and facilitating their access to credit and product markets.
- Speed up the use of concessions for sustainable forest management, including in eligible protected areas, by simplifying procedures and improving capacity of government officials to design and negotiate concession contracts; systematically monitor the areas under concession to ensure compliance with the contract specifications and delivery of the expected environmental and social outcomes.
- Accelerate the development of the proposed National Plan for Native Vegetation Recovery, estimate its costs and identify priority areas (with high biodiversity value) for restoration; identify funding sources and assess the feasibility of extending the existing tax-free infrastructure bonds to restoration investment.

**Recommendations on conservation and sustainable use of biodiversity (cont.)**

- Further encourage the private sector to implement sustainable and traceable value chains that would minimise their impact on biodiversity and ecosystems, including deforestation.
- Adopt a national REDD+ strategy at the earliest opportunity, indicating objectives, actions, institutional arrangements, monitoring mechanisms and the necessary resource allocation.

**Payments for ecosystem services (PES)**

- Continue discussing the current federal legislation proposal and adopt an overarching federal PES law to provide a framework for PES implementation and improve consistency across state regulations and programmes.
- Put in place a countrywide monitoring system for PES programmes, possibly within the framework of a federal PES law, with a view to verifying their effectiveness in maintaining the ecosystem services that are being paid for.
- Scale up and improve the management of Bolsa Verde and reinforce its link with the Rural Environmental Cadastre; ensure adequate training of beneficiaries to help them meet their conservation commitments.

**Mainstreaming biodiversity in sectoral policies**

- Re-orient agricultural support to encourage environmental improvement and efficient use of agricultural inputs.
- Reform land taxation to encourage land conservation and gradually remove the tax exemptions on fertilisers and pesticides; use the resulting tax revenue to improve farmers' knowledge of good agricultural practices such as alternative pest control methods; review the pesticide regulations to make licences subject to periodic renewal and intensify efforts to control unauthorised pesticide use.
- Introduce measures to improve sustainability of fishing in marine and inland waters, including fish catch quotas, management plans for overexploited species and the extension of marine protected areas, particularly in coastal and marine areas where fish stocks are at their limits.
- Introduce strategic planning, including environmental assessment procedures, for hydropower development so as to identify where energy capacity could be built with the least environmental impact, take account of cumulative effects and, ultimately, reduce the costs of mitigating the environmental and social impact.
- Clarify the rules for biodiversity and finance compensations in the framework of the licensing process; improve the quantification of the impact of infrastructure projects on biodiversity and ecosystems and the definition of the associated compensatory measures.

and the development of sustainable economic activities in rural areas. In addition, indigenous lands cover about 13% of the territory, mostly in the Amazon region. Brazil thus has already exceeded the Aichi target of protecting at least 17% of its terrestrial and inland water areas by 2020.

Most new protected areas are in the Amazon biome, reflecting government efforts to fight deforestation there. The Amazon Region Protected Areas (ARPA) programme, launched in 2002, has been at the heart of this progress. One of the world's largest tropical forest conservation programmes, it created more than 500 000 km<sup>2</sup> of federal and state-level protected areas in the biome, including along the so-called "deforestation arc" and in areas expecting road infrastructure development. It has also effectively supported the

operation of protected areas by investing in basic infrastructure and capacity building. The ARPA programme complemented the PPCDAm in reducing deforestation in the region (Figure 3) and, in turn, greatly contributed to the achievement of Brazil's climate change goals (see also Sections 1 and 4).

Coverage of protected areas also increased in the other biomes, but varies widely, from nearly 27% in the Amazon to less than 3% in the Pampa. More efforts thus are needed in areas outside the Amazon biome if Brazil is to meet its ambitious targets of protecting at least 30% of the Amazon and 17% of the other terrestrial biomes by 2020. The implementation and enforcement of the new Forest Code will contribute to achieving these targets by expanding the areas under protection within private lands (Section 4). Only 1.5% of coastal and marine areas are under environmental protection; the government is scaling up efforts to bring this share to 5% by 2020, still far from the Aichi target of 10%, however.

### ***The institutional framework***

The MMA oversees and co-ordinates the SNUC. Executing agencies at each level of government are responsible for implementation. As in many federal countries, a national agency, the Chico Mendes Institute for Biodiversity Conservation (ICMBio), is responsible for overseeing all aspects of federal protected areas. The ICMBio, established in 2007, has helped improve the transparency and effectiveness of the SNUC. The ICMBio operates regional offices that facilitate co-operation with state governments and protected area managers. Yet the large number of protected areas at all levels of government makes effective communication and co-operation challenging. International co-operation and NGOs often play complementary roles and support the planning and operation of protected areas; engagement by the business sector is still limited.

### ***Establishment of protected areas***

As in all countries, the majority of lands that are or may be included in protected areas are inhabited and intended for economic activities. In addition, some areas can be important for potential infrastructure and urban development. The SNUC law acknowledges that consideration must be given to competition among environmental, social and economic interests when establishing protected areas. It requires public consultations with local communities, stakeholders and relevant sectoral institutions to be conducted prior to the establishment of protected areas at all levels of government. As in other countries, this process can take some years. To further extend the area under environmental protection, Brazil could promote the establishment of private protected areas, formally recognised by the SNUC, notably in border zones of existing protected areas. The implementation of the Forest Code may encourage landowners to set up protected areas to effectively preserve and manage the set-aside lands (Section 4).

Some SNUC categories, including national parks, are of exclusively public domain. Establishing such a protected area requires private lands within its boundaries to be expropriated and the owners compensated. Partly because of the approach used before 2000, about 70% of federal protected areas, or 7% of their surface, include some land on which there are private property claims (Veríssimo et al., 2011). The expropriation and compensation of private properties in exclusively public protected areas is expected to require considerable financial resources. The resolution of problems related to territorial consolidation and land tenure sometimes exceeds environmental authorities' capacity and responsibility (TCU, 2013).

To help consolidate public protected areas, the 2012 Forest Code introduced an innovative offset mechanism. It will allow landholders that do not meet their forest set-aside obligations to compensate this deficit by buying private property within official protected areas on behalf of the government, thus reducing the burden of territorial consolidation on the public budget. To be operational, the offset mechanism requires the Rural Environmental Cadastre to be fully implemented. Brazil could consider using transitional contractual agreements with owners of lands within protected areas to ensure that their land use does not conflict with conservation objectives until land tenure disputes are resolved.

### **Effective management of protected areas**

Following the remarkable expansion of protected areas over the 2000s, Brazil now faces the challenge of effectively managing them. Management efficiency has improved, especially in the areas supported by the ARPA programme. This is due in part to its result-based approach, the considerable financial resources available to the programme and the requirement that both federal and state governments contribute qualified staff to manage the ARPA areas. However, many protected areas do not yet fully meet their objectives (TCU, 2013; WWF and ICMBio, 2012).

Many protected areas have been operating without a management plan for more than 10 years, even though such plans are required by law. As the management plan is a condition for sustainable public use (such as tourism, environmental education and sustainable logging) and local community resource use (e.g. harvesting, fishing, farming), its absence reduces socio-economic development opportunities in the longer term and could hinder effective control over resource use in the area. Most federal protected areas have a management committee, composed of government officials and representatives of civil society and the private sector. Many committees still have to define their operating rules to ensure effective stakeholder participation and resolve and prevent conflicts.

Several official protected areas and indigenous lands can be integrated into a so-called mosaic, whose aim is to facilitate co-ordination among managers and achieve economies of scale, for example in monitoring, enforcement and the promotion of sustainable production and commercialisation of natural resources. The MMA has approved 14 mosaics, but there is no evidence that they have helped improve management effectiveness.

Demonstrating how protected areas can contribute to environmental conservation and sustainable development is critical for securing political and societal support and mobilising resources. For example, Brazil's protected areas significantly contribute to the conservation and provision of water resources and have high economic potential (Medeiros and Young, 2011). The ICMBio has monitored coral reefs in marine protected areas since 2002 and launched *in situ* monitoring programmes in terrestrial federal protected areas in 2012. Most protected areas, however, struggle to monitor the state and trends of biodiversity and socio-economic development outcomes. Further encouraging partnerships with civil society, research and business organisations could help develop monitoring in areas not supported by ICMBio programmes.

### **Human resources**

A shortage of human resources is among the main causes of the generally weak management performance. Managing the vast territory covered by the SNUC requires numerous well-trained staff members. There is evidence that current staff is insufficient:



estimates indicate that in the late 2000s, staff per square kilometre of protected area was lower than in other Latin American countries (Medeiros and Young, 2011). Government estimates suggest that operating federal and state protected areas needs at least 19 000 additional workers, three-quarters of them for field activities.

Attracting staff for long periods has proved difficult in some areas, notably in remote regions of the Amazon, where working and living conditions are demanding. Strict employment regulations for the public sector are an additional obstacle. While generally highly motivated and committed, many managers and staff are not adequately trained for day-to-day management activities, although several training programmes have helped improve capacity in recent years. Realising the full environmental, social and economic potential of protected areas requires additional skills and expertise, including in financial and project management. The lack of these skills, combined with red tape, has sometimes resulted in financial resource being unspent. Experience from other sectoral programmes (e.g. for health care) can help identify strategies for attracting qualified staff for managing remote protected areas.

### **Financial resources**

The budget of the ICMBio, the main source of SNUC finance, grew by 57% between 2008 and 2014. Overall, however, the increase in resources is not proportional to the expansion of the areas under environmental protection, resulting in a considerable financial gap – a situation common to most Latin American countries (Bovarnick et al., 2010). The operation of the SNUC heavily relies on federal and state budgets, which makes funding vulnerable to external factors and political negotiations. Resources are largely used to cover staff and other operational costs, while investment in equipment and infrastructure is relatively modest. Other sources of finance include environmental compensation, international development co-operation, private donations and revenue from tourism and sustainable forestry, although the latter are still limited.

Brazil pioneered the use of fiscal transfers as an incentive for biodiversity conservation in protected areas. About half the states redistribute a share of the revenue from the state-level value added tax (ICMS) on the basis of environmental criteria under a mechanism called Ecological ICMS. The main parameter is the extension and type of protected areas and indigenous lands. In practice, the Ecological ICMS has been used to compensate municipalities for the opportunity cost of maintaining part of their territory under nature protection. While the revenue is not necessarily used to finance expenditure in protected areas, the mechanism has helped increase the number and size of protected areas in Brazil. The impact on biodiversity conservation is not clear, however (May et al., 2012). Only one state makes the revenue transfers conditional on quality indicators of protected area status and on municipal resources dedicated to conservation actions. This mechanism is potentially more effective in encouraging good protected area management, but entails additional cost, including for periodic inspection of the areas.

Brazil has attracted substantial international finance for protected areas, especially through the ARPA programme. Germany is the largest donor to the programme. While international co-operation accounts for a limited share of the SNUC budget, it has helped leverage domestic finance and improve resource use effectiveness. However, funding from international co-operation is likely to gradually decline in the years to come. The MMA and ICMBio envisage the shift of the ARPA programme from donation based to government financed over 25 years and has set up a transition fund for the purpose. This model could

be extended to the entire SNUC. Brazil would benefit from developing a comprehensive financial strategy for the SNUC and for biodiversity policy more generally. Such a strategy should consider alternative funding sources, including PES programmes, concessions for tourism services and sustainable forest management (Section 4).

### **Promoting public visitation**

There is room to better integrate protected areas into Brazil's wider tourism strategy. Public visitation for tourism, recreation and environmental education purposes is one of the most relevant ways to enhance social and economic benefits and increase financial sustainability of, and public support for, protected areas. While expanding, public visitation is still in its infancy. The number of annual visits has increased steadily since 2006. They are largely concentrated in few major national parks where government programmes such as Tourism in the Parks and private investment allowed for developing infrastructure and provision of tourism services. It is estimated that roughly two-thirds of protected areas received visitors in 2012, often in limited numbers, although not all protected areas track and report the number of visitors. However, less than 20% of the areas generated revenue from access fees and other public visitation charges (Semeia, 2012).

Few protected areas engaged in partnerships with private businesses and non-profit organisations to manage visitation services. This is mainly due to regulatory constraints and red tape, the lack of adequate management plans, and limited resources and capacity on the part of the park management. Public-private partnerships (PPPs), including concessions, can help strengthen management capacity and increase investment. In 2011, the MMA and the Ministry of Planning, Budget and Management agreed to launch pilot PPP and concession agreements in 10 national parks with high tourism potential. Such agreements could be extended to the full management of protected areas, including environmental conservation activities. This would allow the public authorities to shift their attention from direct management to oversight of protected areas, which is less resource intensive.

### **Extractive and sustainable development reserves**

Extractive and sustainable development reserves are inhabited by small traditional communities, which depend on natural resources (e.g. fish, wood, nuts, oils, rubber) for their livelihoods. Effective management of these areas requires offering such communities meaningful opportunities to sustainably use natural resources. Although traditional communities generally have good knowledge of the use of natural resources, they often lack sufficient expertise for sustainable farming, forestry and fishing, as well as access to markets. Programmes such as Bolsa Floresta and Bolsa Verde (Section 4) and the minimum price policy for socio-biodiversity products – a joint programme of the MMA and the ministries for agrarian and social development – aim to address these issues. As benefiting from such programmes tends to be easier in extractive and sustainable development reserves, some communities have requested this status for the area they live and work in.

In addition to viable sources of livelihood, much of the population living in extractive reserves needs better access to social services such as education, health and sanitation. Overall, this mix of issues goes beyond the responsibilities of the MMA and other environmental authorities and calls for stronger intersectoral co-ordination.

### Recommendations on protected areas

#### Expansion and consolidation of the national system of protected areas

- Strengthen inter-institutional co-operation to ease the resolution of land tenure issues within existing or proposed new protected areas and improve social service provision to communities living in sustainable use reserves.
- Further expand the area under environmental protection to fully achieve the national 2020 targets and international commitments (including through official protected areas, indigenous lands and set-aside areas required by the Forest Code); prioritise areas with high biodiversity values and where pressures from infrastructure development, urbanisation and agriculture are the highest; expand the coverage of protected areas in marine and coastal zones to achieve the Aichi target.
- Develop a strategy for the territorial consolidation of protected areas; encourage the use of financial and land offset mechanisms provided in the protected area legislation and in the Forest Code once the Rural Environmental Cadastre is fully operational; and explore the use of transitional contractual agreements with landowners within protected areas to ensure compatible land use until property rights are clarified.

#### Management of protected areas

- Develop a comprehensive financial strategy for the National System of Protected Areas (SNUC), with a view to reducing dependency on the public budget and on international finance; explore alternative funding sources, including payments for ecosystem services, access fees, branding and sale of merchandise, and benefits generated from genetic resources.
- Strengthen efforts to develop the management plans of protected areas and review their implementation; ensure that the plans set clear priorities, targets and progress indicators.
- Develop targeted capacity building and skill development programmes for protected area managers and staff, with a view to enhancing management effectiveness; promote networks of protected area managers and exchange of experiences and best practices.
- Continue to periodically assess protected area management effectiveness and efficiency; further encourage protected area managers to provide accurate and timely information to the National Register of Protected Areas (CNUC), and systematically review this information to derive system-level recommendations.
- Develop standard biodiversity monitoring methods with a view to generating the information needed to assess the environmental effectiveness of protected areas; further expand federal monitoring programmes.
- Integrate protected areas into national and state tourism strategies and identify areas with high tourism potential; develop tourism products linked to protected areas.
- Extend the use of concessions and other public-private partnerships for public visitation and tourism in protected areas; simplify procedures and improve capacity of government officials and protected area managers to design and negotiate contracts; implement pilot programmes to test and develop new management models.
- Consider including regular visits to protected areas in educational programmes of schoolchildren.

## Notes

1. A biome is a large naturally occurring community of flora and fauna occupying a geographic region.
2. The Amazônia Legal super-region covers an area larger than the Amazon biome, encompassing both the Amazonian forest (about 4.1 million km<sup>2</sup>) and transitional vegetation (1 million km<sup>2</sup>); the Amazon biome covers only the forest area. Amazônia Legal takes in the states of Amazonas, Pará, Acre, Roraima, Rondônia, Amapá and Tocantins, and part of Mato Grosso and Maranhão.
3. Quilombolas are inhabitants of quilombos, traditional communities of escaped slaves who fled inland under colonisation.
4. In full, the 2010 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization. It is a protocol to the Convention on Biological Diversity.

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